
Space Weather Technical Forecast

Issued on Tuesday, 15 August 2023 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Chance of G1/Minor Storm, mainly day 1 (15 Aug). Chance of isolated M-flares (R1 Blackouts).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with peak flare C8.9 from AR3405 at 14/2110 UTC. This is a relatively simple bipolar spot on the east limb, however more complexity has the potential to become visible as it rotates into a less oblique viewing angle. There are a total of six numbered, and two newly developing unnumbered regions on the disc. AR3395 continues to decline as it approaches the western limb, while AR3394 persists as a stable mature spot. AR3397 and AR3403, either side of the northern centre disc have stabilised into simple bipolar regions. AR3404 has also seen flux emergence to its northeast, however this remains a unipolar spot for the time being. There were no Earth-directed CMEs.

Solar Wind / Geomagnetic Activity: Slow wind conditions observed by ACE at L1 with wind speeds 320-350 km/s. Density remained below average. Total interplanetary magnetic field (IMF) Bt, was weak, below 5nT, with north-south component, Bz, varying between -4 nT and +5nT. Phi angle was predominately negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background. GOES16 High energy (greater than 2MeV) electron flux varied between background and high with the diurnal cycle, peaking 1250 pfu at 14/1330 UTC. A slower decline was observed than recent days, however. The associated 24-hour integrated fluence remained below Active (1e8 integrated pfu) reaching 4.77e7 integrated pfu at 15/0000UTC.

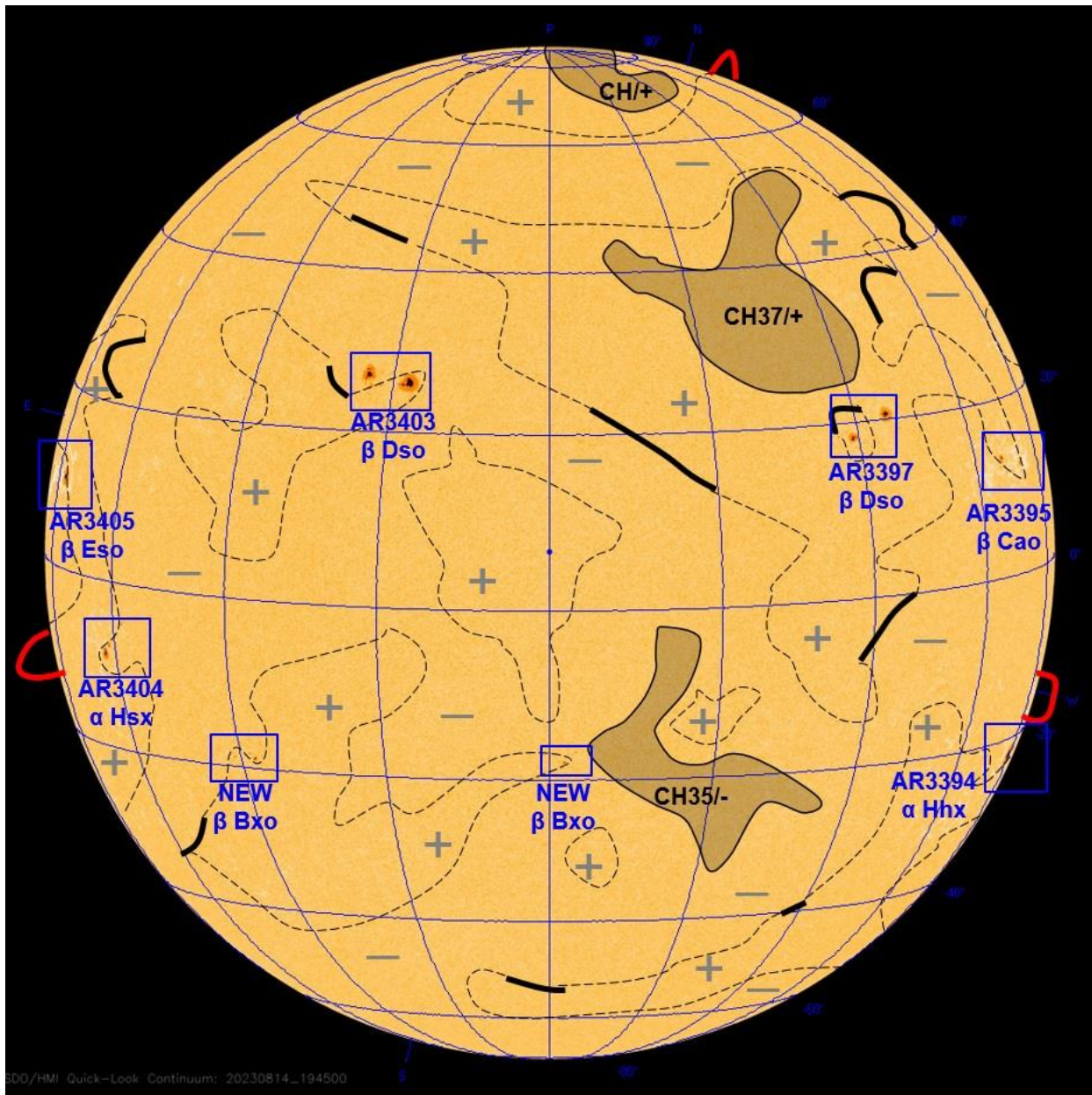
Four-Day Space Weather Forecast Summary

Solar Activity: Mainly Low activity is expected, but with a daily chance of rising to Moderate with isolated M-flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. CH33/+ fast winds are anticipated to arrive day 1 (15 Aug), with solar winds likely rising to around 550km/s. Further enhancements are possible day 2 (16 Aug) from CH35/-, however this is low confidence. Initially Quiet geomagnetic activity is expected to become Unsettled to Active with a likelihood of G1/Minor Storm intervals day 1 (15 Aug). Activity then easing to Unsettled to Active, but with an ongoing slight chance of G1 Minor Storm intervals day 2 and 3 (16-17 Aug).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to persist at background. High energy electron flux (greater than 2MeV) is forecast to continue varying between Background and High, but likely dropping out for a time day 1 (15 Aug). A more persistent recovery to Moderate to High values is then expected follow, however the timing of this flux being observed at GEO is low confidence. Fluence will rise in response, giving a chance of reaching Active, mainly day 3-4 (17-18 Aug).

Figure 1. Solar Analysis Valid 14/2000 UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

There are no Earth-directed CMEs.

Current slow wind conditions are forecast to increase day 1 (15 Aug). This is due to the onset of fast winds from CH33/+ in the northern disc, along with any preceding CIR. As a positive polarity coronal hole, there is a higher chance of a geoeffective connection at this time of year (Russell-McPherron effect). This is also a later onset than MOSWOC Enlil indicates, as the model appears to be anomalously generating a high speed stream from an area of weak fields currently in the west centre disc.

CH35/- on the southern disc has a less certain influence on the expected solar wind conditions, due its negative polarity, and with Earth currently above the ecliptic. This may prolong elevated solar winds day 2 (16 Aug), but with a lower likelihood of significantly enhanced geomagnetic activity. A gradual easing of winds is then expected day 3 (17 Aug) onward.

Initially Quiet activity is expected to become Unsettled to Active with a likelihood of G1/Minor Storm intervals on day 1 (15 Aug). Activity then easing to Quiet to Active, but with an ongoing slight chance of G1 Minor Storm intervals day 2 and 3 (16-17 Aug), before becoming more predominately Quiet with isolated Unsettled spells day 4 (18 Aug).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	60	20	20	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2a: SDO aia 193 (left) and 211 (right) showing clear CHs on northern and southern disc

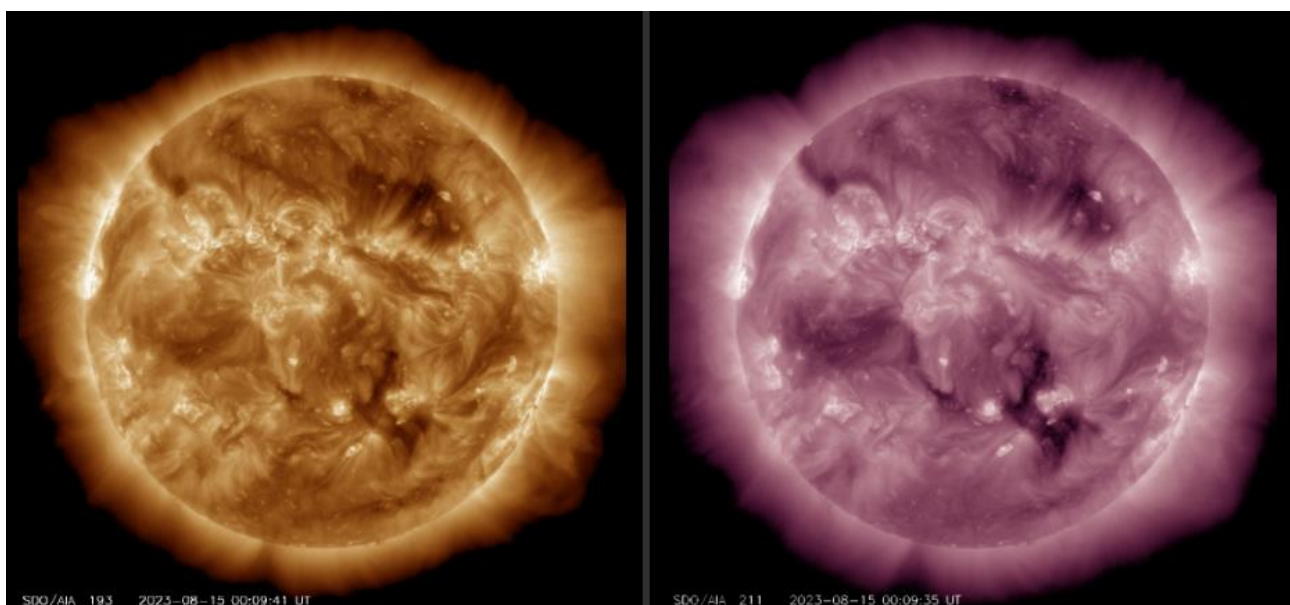


Figure 2b: Enlil, with anomalous winds around 150km/s faster than current observations

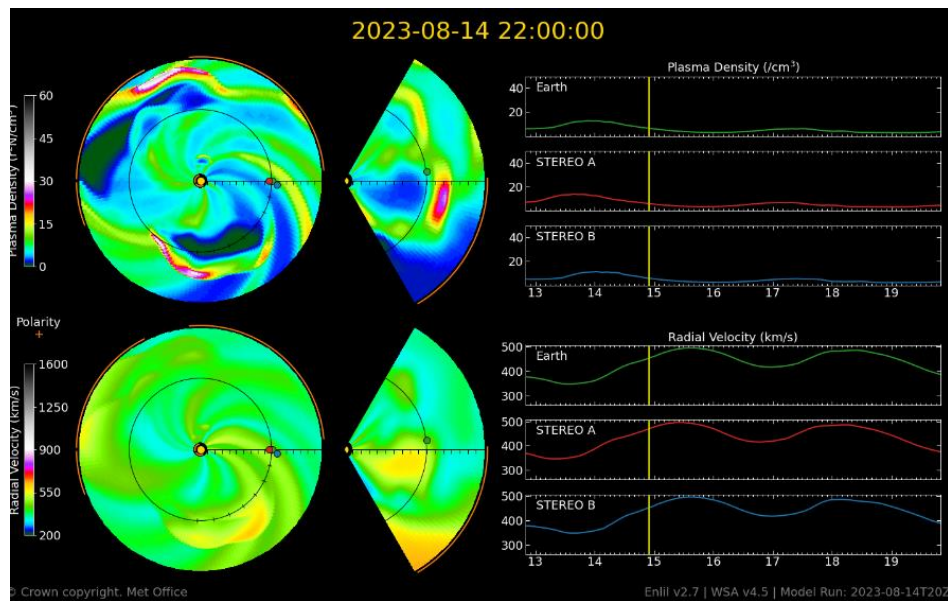
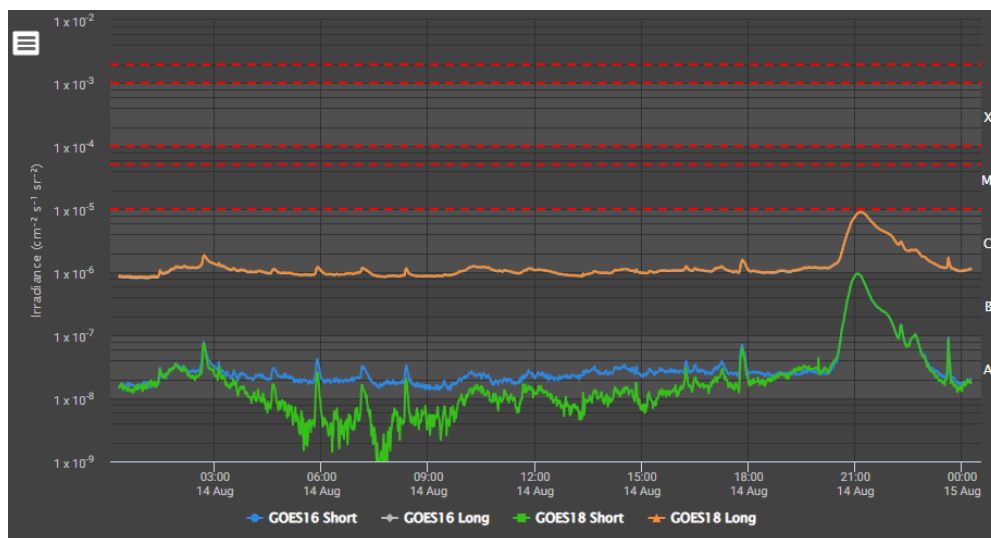


Figure 3: GOES- 16/18 X-ray Flux



Radio Blackouts - X-Ray Flares:

Solar activity is currently Low with six numbered sunspots on the disc, and two unnumbered developing regions. Peak flare was a long period C8.9 at 14/2110 UTC from AR3405 on the east limb, and while currently too close to the limb for an accurate assessment, this region appears to be a simple bipolar group, but perhaps some further complexity will become visible as it rotates to a less oblique viewing angle.

The other five numbered regions currently on the disc remain relatively small and simple, with AR3394 and AR3395 now approaching the northwest limb, with the latter also declining.

Activity is likely to remain Moderate, but with an ongoing chance of isolated M-flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	40	40
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The flux of high energy (greater than 10 MeV) is at background. The sunspots on the visible disc, including those on the western hemisphere, are relatively simple and considered unlikely to produce proton events. Barring any further development, the proton flux is expected to remain at background.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	2	2	2	2
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event ($\geq 2\text{MeV}$):

The high energy (greater than 2 MeV) electron flux at GOES-16 has been varying between background and diurnal peaks of high (above 1000 pfu). The arrival of the next fast wind on day 1 (15 Aug) will likely lead to flux dropping out, before a more persistent rise is expected later day 2 (16 Aug) and beyond. This may be tempered by any further fast wind arrival from CH35/+ around the same time, however this is low confidence.

The associated fluence may approach the Active ($1\text{e}8$ integrated) threshold later day 2, but with an increasing likelihood through days 3 and 4. This is low confidence however. REFM is giving reasonable guidance to current conditions, however this will likely become poor once the arrival of the fast wind of CH33 occurs.

GEO Electron Environment	Level ($\text{cm}^{-2}\text{sr}^{-1}\text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2\text{ MeV}$ $\geq 1\text{x}10^8$	No	1	10	30	40
Very Active	$\geq 2\text{ MeV}$ $\geq 1\text{x}10^9$	No	1	1	1	1

Figure 4: GOES 16>2MeV Electron flux (top) and associated Fluence with REFM and recurrence (bottom)

